**Operation Oil Spill Clean Up**

**Student Investigation**

Offshore oil drilling and the use of supertankers for transporting oil pose the risk of oil spills. Oil spills can damage commercial and recreational fishing areas, spoil beaches, kill marine birds, mammals, and other aquatic life, and destroy shellfish communities. A mere 3.8 L of oil can contaminate as many as 20 million liters of water!

Suppose you are a scientist or an engineer for Eco-Marine, Inc., an environmental remediation firm that specializes in resolving ocean pollution problems. Your supervisor has just sent the email below that describes your latest assignment.

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**To: All Eco-Marine Staff**

**From: Marina Waters, Lead Scientist Oil-Spill Cleanup Proposal**

**Re: Oil-Spill Cleanup Proposal**

I would like to inform you that Del Mar Oil Company is accepting proposals for a cleanup plan that could be implemented in the event of an oil spill from one of the many supertankers that sail the seas. There are several top-notch companies competing for this contract, but I am confident that we at Eco-Marine, Inc. can develop the best plan for oil spill cleanups that is fast and effective yet has a minimum impact on the affected marine ecosystems.

I would like each team in my department to develop its own plan. The first part of your plan should test the various cleanup materials currently available. Phase two of your plan should involve using the materials to clean up on a small-scale oil spill along a model beachfront. Once all the plans have been tested, we will decide which to submit to Del Mar Oil Company.

Sincerely,

Marina Waters, Lead Scientist

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**Overall task** – You and your team will go through the scientific method and create a lab experiment to determine the effectiveness of materials at cleaning up a simulated oil spill. You will have limited time for the actual experimenting – so plan accordingly! You will take notes during the investigation in your lab INB or on a google document. Based on these notes, you will each write a formal lab write up on your research, the investigation, reporting the findings and sharing results, and finally include an independent conclusion based on the team’s work.

Your lab report should be typed and must follow the formal lab report format.
Investigation

Objectives:

- Research oil spills damages to ecosystems and clean-up methods
- Select various materials and use them to determine their effectiveness at cleaning up a model oil spill.
- Design an experiment to clean up a model oil spill.
- Test the plan and evaluate the results.
- Write a formal lab report, with the conclusion including research

Provided Materials:

- Beakers, measurement equipment
- Water
- Aluminum pan (1 per group)
- Test tubes

Possible Materials (students bring in from home): Use the below for inspiration

Oil – cooking oil only – 1 bottle per group

Potential cleanup materials: spoons, toothpicks, drinking straws, plastic wrap, aluminum foil, pieces of plastic foam, string, pieces of brown paper bag, cotton balls, pieces of nylon stocking, pieces of sponge, paper towels, coffee filters, cloth, liquid detergent, cat litter, baking soda, flour, vinegar, etc.

PART I—BRAINSTORM, RESEARCH AND DESIGN PROTOTYPE

1. Work with a team of students as assigned by your teacher. Make sure that lab notes are being kept. The easiest method is by keeping a shared google document up and running while you work
2. Determine a question that your hypothesis will answer.
3. Brainstorm and research some design ideas to separate oil and water.
4. Write a hypothesis to “answer” your posed question. The hypothesis should address the method you believe will be the best for cleanup and why.
5. Determine how you will measure the amounts of water and oil you started with and then the amounts once they are separated.
6. Choose what items each person will bring in – when items are dropped off, they must be labelled with class period and group names.

PART II—DEVISING A PLAN AND WRITING PROCEDURE

1. Work with the other members of your group to devise a plan (based on your hypothesis) for cleaning up an oil spill. Note that your plan must specify which materials and techniques you will use for containing the spill, cleaning up the water and recovering the oil.
2. Write out this plan in procedural steps on the google document.
3. Decide how you will measure the amount of oil cleaned up. The decide what data about it you will record. An example is provided below:
   Oil Spill cleanup - what volume percent of the liquid you skimmed into your test tube is oil? (show a ratio value or percentage) ____________________________
   How did you arrive at this answer? ________________________________________________
PART III—TESTING THE PLAN AND RECORDING RESULTS

1. Have the data table ready in your google document.
2. Take pictures of each step, as well as results – you will include these in your final lab report
3. Run the experiment at least 3 times, 5 trials are optimal. For each trial, measure the amount of water and oil you start with. Then make sure to measure how much oil you removed from the water. Also note what the qualities of the water that is “left” are like. (for example, does it still have a lot of oil, or is the oil no longer visible, etc.)
4. Keep track of any other qualitative data as well. This helps you “paint a picture” of the experiment.

Analysis Questions:

Use these questions to help guide you in writing your conclusion.

- How much of the original spill was your group able to recover?
- What happened to the oil that was not recovered and was left?
- How effective was your prototype? Can you quantify this?
- How would you approach this problem again (lessons learned)

Conclusion:

Your conclusion should have the following paragraphs:

1. Write a summary paragraph on your experiment and the device your team built to tackle the task of cleaning up an oil spill. Explain how you think this device would answer the experiment’s main question.

2. What were the results collected? (Summarize your collected data and observations – give specific examples of the data and explain what the data shows). This is a good place to answer some of the above analysis questions!!

3. How was the hypothesis supported by the data? State the hypothesis and include data to demonstrate how you know that the hypothesis was supported or not supported.

4. Don’t give the procedure again, but do point out possible sources of error that may have occurred in the collection of data and suggest improvements. What were the lessons learned? Again, answer some of the above questions from the analysis questions section.
### Criterion B: Inquiring & Designing

- i. describe a problem or question to be tested by a scientific investigation
- ii. outline a testable hypothesis and explain it using scientific reasoning
- iii. describe how to manipulate the variables, and describe how data will be collected
- iv. design scientific investigations

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<th>Level</th>
<th>Descriptor – The student is able to:</th>
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| 1-2   | i. **state** a problem or question to be tested by a scientific investigation, with **limited success**  
ii. **state** a testable hypothesis  
iii. **state** the variables  
iv. design a **method**, with **limited success** |
| 3-4   | i. **state** a problem or question to be tested by a scientific investigation  
ii. **outline** a testable hypothesis **using** **scientific reasoning**  
iii. **outline** how to manipulate the variables, and **state** how **relevant** data will be collected  
iv. design a **safe** method in which he or she **selects materials and equipment** |
| 5-6   | i. **state** a problem or question to be tested by a scientific investigation  
ii. **outline and explain** a testable hypothesis **using** **scientific reasoning**  
iii. **outline** how to manipulate the variables, and **outline** how **sufficient, relevant** data will be collected  
iv. design a **complete and safe** method in which he or she **selects appropriate materials and equipment** |
| 7-8   | i. **describe** a problem or question to be tested by a scientific investigation  
ii. **outline and explain** a testable hypothesis **using** **correct scientific reasoning**  
iii. **describe** how to manipulate the variables, and **describe** how **sufficient, relevant** data will be collected  
iv. design a **logical, complete** and safe method in which he or she **selects appropriate materials and equipment** |

### Criterion C: Processing & Evaluating

- i. present collected and transformed data
- ii. interpret data and describe results using scientific reasoning
- iii. discuss the validity of a hypothesis based on the outcome of the scientific investigation
- iv. discuss the validity of the method
- v. describe improvements or extensions to the method

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<th>Level</th>
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| 1-2   | i. **collect and present** data in numerical and/or visual forms  
i. **accurately interpret** data  
iii. **state** the validity of a hypothesis with **limited reference** to a scientific investigation  
iv. **state** the validity of the method with **limited reference** to a scientific investigation  
v. **state** limited improvements to the method |
| 3-4   | i. **correctly collect and present** data in numerical and/or visual forms  
i. **accurately interpret** data and **describe** results  
iii. **state** the validity of a hypothesis based on the outcome of a scientific investigation  
iv. **state** the validity of the method based on the outcome of a scientific investigation  
v. **state** improvements to the method that would benefit the scientific investigation |
| 5-6   | i. **correctly collect, organize and present** data in numerical and/or visual forms  
i. **accurately interpret** data and **describe** results **using** **scientific reasoning**  
iii. **outline** the validity of a hypothesis based on the outcome of a scientific investigation  
iv. **outline** the validity of the method based on the outcome of a scientific investigation  
v. **outline** improvements to the method that would benefit the scientific investigation |
| 7-8   | i. **correctly collect, organize, transform and present** data in numerical and/or visual forms  
i. **accurately interpret** data and **describe** results **using** **correct scientific reasoning**  
iii. **discuss** the validity of a hypothesis based on the outcome of a scientific investigation  
iv. **discuss** the validity of the method based on the outcome of a scientific investigation  
v. **describe** improvements to the method that would benefit the scientific investigation |